

**WHAT IS CLAIMED IS:**

1. An isolated and purified *Bacillus thuringiensis* CryET29 crystal protein.
- 5 2. The protein according to claim 1, comprising the amino acid sequence of SEQ ID NO:2.
- 10 3. An isolated and purified CryET29 crystal protein having insecticidal activity against the southern corn rootworm, *Diabrotica undecimpunctata howardi*, the Colorado potato beetle, *Leptinotarsa decemlineata*, the western corn rootworm, *Diabrotica virgifera virgifera*, the Japanese beetle, *Popillia japonica*, the red flour beetle, *Tribolium castaneum*, or the cat flea, *Ctenocephalides felis*.
- 15 4. The protein of claim 3, wherein said crystal protein is isolated from *Bacillus thuringiensis* EG4096, EG11494, or EG11502.
- 20 5. The protein of claim 5, wherein said crystal protein is about 25-Da as determined by SDS-PAGE.
- 25 6. A purified nucleic acid segment encoding a *B. thuringiensis* CryET29 crystal protein.
7. The nucleic acid segment of claim 6, wherein said segment encodes a  $\delta$ -endotoxin
- 30 having insecticidal activity against the western corn rootworm, the southern corn

rootworm, the Colorado potato beetle, the Japanese beetle, the red flour beetle or the cat flea.

- 5        8.        The nucleic acid segment of claim 6, further defined as encoding a protein comprising the amino acid sequence of SEQ ID NO:2.
- 10       9.        The nucleic acid segment of claim 8, further defined as comprising the nucleic acid sequence of SEQ ID NO:1, or the complement thereof, or a sequence which hybridizes to the sequence of SEQ ID NO:1.
- 15       10.       The nucleic acid segment of claim 8, further defined as an RNA segment.
11.       A nucleic acid segment comprising a *B. thuringiensis cryET29* gene.
- 20       12.       The nucleic acid segment of claim 11, comprising a *cryET29* gene that encodes a crystal protein or peptide that comprises at least a fifteen-amino acid contiguous sequence from SEQ ID NO:2.
- 25       13.       The nucleic acid segment of claim 12, comprising at least an eighteen basepair contiguous nucleic acid sequence from SEQ ID NO:1.
- 30       14.       The nucleic acid segment of claim 11, comprising a *cryET29* gene that encodes a crystal protein or peptide of from about 15 to about 50 amino acids in length.

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15. The nucleic acid segment of claim 14, comprising a *cryET29* gene that encodes a crystal protein or peptide of from about 15 to about 100 amino acids in length.
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16. The nucleic acid segment of claim 15, comprising a *cryET29* gene that encodes a crystal protein or peptide of from about 15 to about 150 amino acids in length.
17. The nucleic acid segment of claim 16, comprising a *cryET29* gene that encodes a crystal protein or peptide of from about 15 to about 200 amino acids in length.
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18. The nucleic acid segment of claim 11, comprising a *cryET29* gene that encodes a crystal protein or peptide of about 231 amino acids in length.
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19. The nucleic acid segment of claim 11, further comprising a recombinant vector.
20. The nucleic acid segment of claim 11, further defined as recombinant vector pEG1298 or pEG1299.
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21. The nucleic acid segment of claim 11, wherein said nucleic acid is operatively linked to a promoter, said promoter expressing the nucleic acid segment.
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21. The nucleic acid segment of claim 11, further defined as a DNA segment.

22. A recombinant host cell comprising the nucleic acid segment of claim 11.
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23. The recombinant host cell of claim 22, further defined as a prokaryotic cell.
24. The recombinant host cell of claim 23, further defined as a bacterial cell.
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25. The recombinant host cell of claim 24, wherein said bacterial cell is an *E. coli*, *B. thuringiensis*, *B. subtilis*, *B. megaterium*, or a *Pseudomonas* spp. cell.
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26. The recombinant host cell of claim 25, wherein said bacterial cell is *B. thuringiensis* NRRL B-21582, or NRRL B-21583.
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27. The recombinant host cell of claim 35, wherein said bacterial cell is *E. coli* EG11513 or EG11514.
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28. The recombinant host cell of claim 22, defined further as being a eukaryotic cell.
29. The recombinant host cell of claim 28, further defined as a plant cell.

30. The recombinant host cell of claim 29, wherein said plant cell is a corn, wheat, turf grass, potato, vegetable, ornamental, or fruit tree cell.
- 5 31. The recombinant host cell of claim 30 wherein said cell is a corn, wheat or turf grass cell.
- 10 32. The recombinant host cell of claim 22 wherein said DNA segment is introduced into the cell by means of a recombinant vector.
- 15 33. The recombinant host cell of claim 22, wherein said host cell expresses the DNA segment to produce a CryET29 crystal protein or peptide.
- 20 34. The recombinant host cell of claim 33, wherein said CryET29 crystal protein or peptide comprises at least a fifteen-amino acid contiguous sequence from SEQ ID NO:2.
- 25 35. The recombinant host cell of claim 33, wherein said CryET29 crystal protein or peptide is encoded by a nucleic acid sequence comprising at least an eighteen-basepair contiguous nucleic acid sequence from SEQ ID NO:1.
36. A method of using a DNA segment that encodes an isolated CryET29 crystal protein or peptide, comprising the steps of:

- (a) preparing a recombinant vector in which a CryET29 crystal protein or peptide-encoding DNA segment is positioned under the control of a promoter;
- 5 (b) introducing said recombinant vector into a host cell;
- (c) culturing said host cell under conditions effective to allow expression of the encoded CryET29 crystal protein or peptide; and
- 10 (d) collecting said expressed CryET29 crystal protein or peptide.
37. The method of claim 36, wherein said recombinant vector is pEG1298, pEG1299, pEG1302, or pEG1303.
- 15 38. An isolated nucleic acid segment characterized as:
- (a) a nucleic acid segment comprising a sequence region that consists of at least  
20 18 contiguous nucleotides that have the same sequence as, or are complementary to, 18 contiguous nucleotides of SEQ ID NO:1
- (b) a nucleic acid segment of from about 18 to about 10,000 nucleotides in length that hybridizes to the nucleic acid segment of SEQ ID NO:1; or the  
25 complement thereof, under standard hybridization conditions.
39. The nucleic acid segment of claim 38, further defined as comprising a sequence region that consists of at least about 18 contiguous nucleotides that have the same

sequence as, or are complementary to, at least about 18 contiguous nucleotides of SEQ ID NO:1.

5      40.      The nucleic acid segment of claim 46, further defined as comprising a nucleic acid segment of from about 18 to about 10,000 nucleotides in length that hybridizes to the nucleic acid segment of SEQ ID NO:1, or the complement thereof, under standard hybridization conditions.

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41.      A method for detecting a nucleic acid sequence encoding a CryET29 crystal protein, comprising the steps of:

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(a)      obtaining sample nucleic acids suspected of encoding a CryET29 crystal protein;

(b)      contacting said sample nucleic acids with an isolated nucleic acid segment encoding a CryET29 crystal protein under conditions effective to allow hybridization of substantially complementary nucleic acids; and

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(c)      detecting the hybridized complementary nucleic acids thus formed.

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42.      The method of claim 41, wherein said CryET29 crystal protein comprises at least a fifteen-amino acid contiguous sequence from SEQ ID NO:2 or is encoded by a nucleic acid sequence comprising at least an about eighteen-basepair contiguous nucleic acid sequence of SEQ ID NO:1.

43. The method of claim 41, wherein the isolated CryET29 crystal protein-encoding nucleic acid segment comprises a detectable label and the hybridized complementary nucleic acids are detected by detecting said label.
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44. A nucleic acid detection kit comprising, in suitable container means, CryET29 crystal protein-encoding nucleic acid segment and a detection reagent.
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45. A composition comprising a CryET29 crystal protein that comprises an at least fifteen amino-acid contiguous sequence from SEQ ID NO:2.
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46. The composition of claim 45, comprising a peptide that includes a 15 to about 150 amino acid long sequence from SEQ ID NO:2.
47. A purified antibody that binds to a CryET29 crystal protein or peptide.
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48. A method for detecting a CryET29 crystal protein or peptide in a biological sample, comprising the steps of:
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- (a) obtaining a biological sample suspected of containing a CryET29 crystal protein or peptide;
- (b) contacting said sample with an antibody that binds to a CryET29 crystal protein or peptide, under conditions effective to allow the formation of complexes; and
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(c) detecting the complexes so formed.

5 49. An immunodetection kit comprising, in suitable container means, an antibody that binds to a CryET29 crystal protein or peptide, and an immunodetection reagent.

10 50. A method of treating flea infestation of an animal, comprising administering to said animal a therapeutically-effective amount of a pharmaceutically-acceptable CryET29 composition.

15 51. The method of claim 50, wherein said animal is feline or canine.

52. The method of claim 50, wherein said CryET29 composition is administered topically or systemically to said animal.

20 53. A composition comprising a pharmaceutically-acceptable formulation of the CryET29 composition of claim 45.

25 54. The composition of claim 53, further defined as a flea collar, flea powder, flea spray, or flea dip.

30 55. A therapeutic kit comprising, in suitable container means, the composition of claim 53, and a pharmaceutically acceptable excipient.

56. The therapeutic kit of claim 55, wherein said pharmaceutically-acceptable composition comprises a purified CryET29 protein composition or a recombinant host cell expressing said CryET29 protein.
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57. A fertile, transgenic plant, the genetic complement of which has been altered through the addition of a gene that encodes a CryET29 crystal protein or peptide, wherein said gene confers upon said plant a phenotypic trait that is not found in the parentage of said plant.
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58. The transgenic plant of claim 57, wherein said functional genetic element comprises a *cryET29* gene.
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59. Cells obtained from the transgenic plant of claim 57.
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60. Progeny of the plant of claim 57.
61. Seeds from the progeny of claim 59.
- 25
62. The transgenic plant of claim 57, wherein said functional genetic element comprises a promoter and 3' region operatively linked to said gene.
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63. A *Bacillus thuringiensis* cell that produces a CryET29 crystal protein.

64. The cell of claim 63 , wherein said *B. thuringiensis* cell is an NRRL B-21582 cell.
- 5
65. A *Bacillus thuringiensis* cell having the NRRL accession number NRRL B-21582.
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66. A composition comprising from about 1% to about 50% by weight of a CryET29 crystal protein.
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67. A composition comprising a CryET29 crystal protein prepared by a process comprising the steps of:
- a) culturing a *Bacillus thuringiensis* NRRL B-21582 cell under conditions effective to produce a CryET29 crystal protein; and
  - 20 b) obtaining said CryET29 crystal protein from said cell.
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68. The composition of claim 67, wherein step b further comprises obtaining said CryET29 crystal protein in an amount from between about 1% to about 50% by weight.
69. A method of preparing a CryET29 crystal protein comprising:

- a) culturing a *Bacillus thuringiensis* NRRL B-21582 cell under conditions effective to produce a CryET29 crystal protein; and
- b) obtaining said CryET29 crystal protein from said cell.

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70. The composition of claim 66, prepared by the method of claim 69.